

Splitting light, coloured filters, lenses and the eye

Grade 8 science (Year 9 · Class 8) · Worksheet answers

Compare your working with these model answers. Each one gives the method first and the final result in bold. For colour problems, always list which colours are reflected, transmitted or absorbed before you decide what is seen.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS4-2

Problem 1 Spectrum order

1. The effect is **dispersion**.
2. The order is **red, orange, yellow, green, blue, violet**.
3. Violet bends most: **violet**.

Problem 2 Mixing coloured lights

1. Red + green makes **yellow**.
2. Green + blue makes **cyan**.
3. All three together make **white**.

Problem 3 Parts of the eye

1. A is the **cornea**, B the iris, C the lens, D the retina and E the optic nerve.
2. The cornea (A) bends the light most: **A, cornea**.
3. The retina holds the light-sensitive cells: **D, retina**.

Problem 4 Blue torch filter

1. Only blue passes: **blue**.
2. The filter **absorbs** the red and green light.
3. A red filter transmits only red, and there is no red in the beam, so **no light emerges**.

Problem 5 Lens vocabulary

1. $25 \text{ cm} \div 100 = \mathbf{0.25 \text{ m}}$.
2. The rays meet at the focal point, **25 cm** from the lens.
3. It is **thicker in the middle than at the edges**.
4. A fatter lens bends light more, so the focal length is **shorter**.

Problem 6 Magnifying glass

1. $M = h_i \div h_o = 7.5 \div 2.5 = \mathbf{3.0}$.
2. Image height = $3.0 \times 4.0 \text{ cm} = \mathbf{12 \text{ cm}}$.

Problem 7 Banana under coloured lamps

1. White light contains all colours, so it reflects red and green: **yellow**.
2. Red light is reflected: **red**.
3. Blue light is absorbed and nothing else is present, so no light is reflected: **black**.

Problem 8 Focal length and lens power

1. The distance is **8.0 cm**.
2. $8.0 \text{ cm} = 0.080 \text{ m}$.
3. $P = 1 \div 0.080 = \mathbf{12.5 \text{ D}}$.
4. $f = 0.050 \text{ m}$, so $P = 1 \div 0.050 = \mathbf{20 \text{ D}}$. The second lens bends light more because its power is larger.

Problem 9 Diminished image

1. $M = 2.4 \div 6.0 = \mathbf{0.40}$.
2. M is below 1, so the image is **diminished**.
3. Image height = $0.40 \times 15 \text{ cm} = \mathbf{6.0 \text{ cm}}$.

Problem 10 Pupil in bright light

1. Her pupils get **smaller**.
2. The **iris** changes the size of the pupil.
3. A smaller pupil lets less light in, which protects the retina from too much light and keeps the image sharp. **Less light enters the eye**.

Problem 11 Image types from a table

1. 35 cm is beyond 2F (20 cm): real, inverted, smaller. 20 cm is at 2F: real, inverted, same size. 14 cm is between F and 2F: real, inverted, larger. 7 cm is closer than F: virtual, upright, larger.
2. The first three are real: **35 cm, 20 cm and 14 cm**.
3. The magnifying glass case is the object closer than F: **7 cm**.

Problem 12 Spot the errors

1. A filter only removes colours. A red filter absorbs green and blue, so the beam is **dimmer, not brighter**.
2. Violet is bent the most and red the least: **violet bends most**.

Problem 13 Camera and eye

1. The sensor matches the **retina**.
2. The opening matches the **pupil** (controlled by the iris).
3. In both, the image is **real and inverted**.

Problem 14 Measuring the spread of a spectrum

1. Violet is turned more: **violet**.
2. $40.0^\circ - 38.0^\circ = \mathbf{2.0^\circ}$.
3. Width = $2.0 \times 3.5 \text{ cm} = \mathbf{7.0 \text{ cm}}$.

Problem 15 Two filters in a row

1. Yellow transmits **red and green**.
2. Cyan transmits green and blue, so only green passes both: **green**.
3. Magenta transmits red and blue only, so it absorbs the green: **no light emerges**.

Problem 16 Stage lights

1. Red + green makes **yellow**.
2. The shirt reflects blue only, and yellow light (red + green) has none, so it absorbs everything: **black**.
3. Blue light is now present, so the shirt reflects it and looks **blue**. Red + green + blue make **white** on the backdrop.

Problem 17 Slide projector

1. $1.20 \text{ m} = \mathbf{120 \text{ cm}}$.
2. $M = 120 \div 3.0 = \mathbf{40}$.
3. Image distance = 600 cm, so object distance = $600 \div 40 = \mathbf{15 \text{ cm}}$.
4. The image is larger than the object (M above 1), so the slide is between F and 2F.
Between F and 2F.

Problem 18 Short sight

1. Either the eyeball is too long, or the lens and cornea bend light too strongly: **eyeball too long or lens too strong**.
2. A **diverging (concave) lens**.
3. It spreads the rays slightly before they reach the eye, which moves the focus back onto the retina.

Problem 19 Burning paper with sunlight

1. The Sun is far away, so its rays are parallel. The paper goes at the focal length: **12 cm**.

2. Area ratio = $(8.0 \div 1.0)^2 = \mathbf{64}$.
3. The same light power falls on an area 64 times smaller at the focus, so the light is 64 times more concentrated and the paper heats up.

Problem 20 Image on the retina

1. 2.0 cm = **0.020 m**.
2. $M = 0.020 \div 5.1 = \mathbf{0.0039}$ (0.00392).
3. Image height = $1.70 \text{ m} \times 0.00392 = 0.00667 \text{ m} = \mathbf{6.7 \text{ mm}}$.
4. The image is **real and inverted** (and very small).